

FACTOR 3



# THE DIMENSIONALITY OF NATIONS PROJECT

RESEARCH REPORT

FACTOR 2

FACTOR 1

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DEPARTMENT OF POLITICAL SCIENCE

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The Dimensionality of Nations Project

University of Hawaii

RESEARCH REPORT NO. 17

Dynamic Patterns of International Conflict:

A Dyadic Research Design

Warren R. Phillips

Proposal for Ph.D. Dissertation  
submitted to the  
Department of Political Science  
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13. ABSTRACT <p>The proposed study to be outlined here has three goals: first, to find the dimensions of variation among nations with respect to their dyadic conflict behavior over a continuous series of months and to compare these month to month dimensions with dimensions derived through employing an annual time frame; secondly, to ascertain the groups of nation dyads that exhibit similar patterns of conflict behavior over time; and thirdly, to discuss the profiles of dyadic conflict behavior for each of the groups delineated in the analysis.</p> <p>Data have been collected on several measures of foreign conflict behavior over 275 dyads for 1963. These data will be reorganized into 12 month periods, intercorrelated, and factor analyzed. The factors derived from this analysis will then be compared with those derived from the 1963 study of Hall and Rummel, 27. Factor scores for each dyad will be calculated to determine its position along the foreign conflict dimensions. These scores will then be used in the calculation of distances for grouping by direct factor analysis and hierarchical clustering schemes. Profile delineation will be computed using the factor scores for each of the groups derived in the analysis.</p>			

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## I. ABSTRACT

The proposed study to be outlined here has three goals: first, to find the dimensions of variation among nations with respect to their dyadic conflict behavior over a continuous series of months and to compare these month to month dimensions with dimensions derived through employing an annual time frame; secondly, to ascertain the groups of nation dyads that exhibit similar patterns of conflict behavior over time; and thirdly, to discuss the profiles of dyadic conflict behavior for each of the groups delineated in the analysis.

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## II. THE STUDY OF INTERNATIONAL RELATIONS

It is now commonplace to say that the study of international relations has been undergoing a scientific revolution. This revolution seems to be a generally accepted fact.<sup>1</sup> If any work can signify the shift to more systematic, scientific inquiry, it is Quincy Wright's A Study of War, 90, which dwells upon trends, themes, systematic methodologies, and the contributions of the social sciences to international relations. The new emphasis upon analytic components is not divorced from the older schemes, however. Concepts central to the field before the revolution

still title the chapters of texts.<sup>2</sup> The heavy analytical emphasis of current research in international relations has served to tie together older concepts into a theoretical and explanatory nexus. This process was initiated early by the now classical works of Carr, 11, and Morgenthau, 42.

Eighteen years ago, Harold Guetzkow set forth a design for international relations research and theory that pointed in a constructive direction, 25. Guetzkow's idea is simply that the field was so extensive and complex that the best procedure would be to build some clusters or islands of partial theory and research. These clusters were to be connected gradually as relationships among the parts became clarified. The literature on self-examination and evaluation has grown in the eighteen years since Guetzkow wrote his challenge to the field;<sup>3</sup> so too have the quantitative studies in international relations.<sup>4</sup>

In another important early work on theory, Charles McClelland, 38, has suggested that we consider the difference between the body of literature on what constitutes a Theory or model and the "theories" of international relations. Looking at Theory, there are two systems with which every scientist deals. First there is the analytical system composed of absolute truths. This system represents an organization of axioms relevant to the substantive interest of the analyst. In addition to this system, there is the empirical system about which our perceptions provide knowledge. The interfact between the analytical and empirical system is the concern of science. At issue is the accuracy with which this connection is made. The method of science is not the mechanics of data analysis but the rationale on which it bases its acceptance or rejection of hypotheses.



There have been a number of alternative analytical systems employed in an attempt to comprehend the empirical system. The most widely employed method for organizing axioms is used in the logical analyses of the traditional approach. These attempts are quite compatible with the more current, mathematical approaches as has been demonstrated by Russell and Whitehead in Principia mathematica, 68. There have been quite recent attempts to define an analytical system in this manner. The work of Galtung, 22, and Heintz, 32, are the logical organization of a series of hypotheses stemming from concepts of rank disequilibrium.

Proponents of logical approaches in international relations include Rosecrance, 58; Burton, 9; Liska, 32; Moldolski, 46; Haas, 32; and Deutsch, 9. These writers' elaboration of an analytic conceptual scheme is an acknowledged move towards a science of international relations. In being theoretically explicit and in talking in terms of causal relationships, the proponents of this outlook are self-consciously "scientific." But they are scientific largely in form and not substance. Knowledge cannot be accumulated because there are few systematically organized findings. Generalizations cannot be disproven because they lack empirical specificity. And theories, such as Equilibrium, cannot be tested because they lack logical or mathematical rigor.

In the past decade other analytical systems have been used in increasing regularity. The newer techniques can be distinguished from the earlier traditional approach in that they all have attempted to increase the rigor of their definitions to the point where verbal distinctions between cases or objects is replaced by quantitative distinctions. This development can be traced to two groups. Within political science departments, younger men were developing who had had mathematical or

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engineering backgrounds. Scholars like Irvine, Alker, Denton, and Mannell are among this new group whose development coincided with the movement of more traditionally trained men into mathematical analysis (McClelland, Singer, Deutsch, Pool, and North). At the same time, scientists and scholars trained in other disciplines and methodologies and concerned about the consequences of another world war, began to contest prevailing approaches and concepts. Research by Klineberg, Cantril, Richardson, Rappaport, Guetzkow, and Schelling are all examples of this fertilization from other fields.

Perhaps the most widely employed organization of empirical models in international relations has been statistical investigation. The statistical analysis of operationally defined concepts has taken two directions. The most frequently used approach has been descriptive. The work of McClelland, 41, North, Holsti, and Brody, 50, Singer and Small, 71, and Tanter, 84, fit into this group. These men have attempted to define concepts of substantive interest by employing a single variable to represent each concept. Employing statistical techniques, they have then compared several of these concepts.

Some statistical analysts have been explicitly inferential in their approach. That is they have stated an expected relationship and then tested to see if their concepts exhibited these relationships. Among the scholars working in this area have been Riker, 57; Zinnes, 96; Haas, 3; and Brody, 8.

Another attempt to develop an analytical system has been through the use of probability models. Probability models have been used by only a few scholars interested in international relations. Horovath has studied

the probability distributions of wars and mediated their termination, 23, 34. Weiss 69, 90; Barrell, 49; and Richardson, 54; have also studied probability distributions of the occurrence of violent conflicts.

Alternative analytical systems have been developed from the mathematics associated with linear algebra. This branch of mathematics has had considerable impact on the study of international relations. Two related theoretical approaches to theory development, both relying upon linear algebra, have arisen. The newest of the two has been the graph theoretical attempts to describe structure by Brass, 7; McClelland, 39; and Harary, 28. The second and perhaps most widely employed of the linear algebra techniques has been factor analysis. The questions asked in this approach are of the form: To what extent is a set of vectors linearly dependent upon each other for a given range of values, and what are the minimum number of vectors which can represent these values. This method of looking at reality considers a series of variables as vectors spanning the space which locates the entities being studied. It proceeds to delineate the scores for entities on the minimum set of dimensions needed to represent the original variable vectors. The technique is employed at least tacitly by Russett, 69; Alker, 1; Tenter, 85; Jay, 10; Rummel, 62; Cattell, 15; Gregg, and Banks, 24; and Denton and Phillips, 18.

A final form of model building has relied upon classical mathematics, (Richardson, 56; Smoker, 75; and McGuire, 43). In classical mathematics one considers the variables as coordinates of the space being analyzed and then delineates the relationship between the variables by plotting a function. This method begins with knowledge of both the independent and dependent variables and seeks the functions and coefficients which relate the two sets of data. Classical mathematics is distinguishable from

factor analysis in this respect as the latter assumes that data on the dependent variable and a linear function is assumed. The object of factor analysis is to ascertain the linear function which best relates the dependent variables to a set of underlying, but unobserved independent variables.

To date, analytical models have been employed mostly in describing and organizing the empirical system. John R. Platt has pointed out that there is a developmental stage in which every science passes, 54. This stage includes an early period of emphasizing description and taxonomy building. The passage through this stage must be as quick as possible so that theory can become an integral part of the field. Currently, there are few researchers in international relations who have an explicit theoretical model. Riker's coalition building model, Rummel's field theory, and Galtung's rank disequilibrium theory are among the few explicitly stated models.

Given the current descriptive stage of political science, a distinction should be made between mechanistic and abstractive theories of reality. The essence of a mechanistic theory is that some form of visualizable picture should always be employed. That is, one explains the mathematical relationships between his variables by introducing a series of substantively plausible intervening variables that have not been analyzed, but are expected to explain the relationships. Examples are: Deutsch and Singer, 20; Russett, 70; E. Hass, 29; and Singer and Small, 74.

Turning from mechanistic theory to abstractive theory formulations, these attempts accept the mathematical relationship as being interpreted without the addition of a series of mediating or intermediary variables. It is asserted that while there must be a series of agents acting between the variables analyzed, any attempts to delineate them would result in an

infinite search of plausible intervening variables. Examples of work employing an abstractive point of view are: McClelland et al, 42; Rummel, 67; and Smoker, 73.

The advance of scientific theories in international relations certainly awaits the further development of model building. The unfolding of an analytical model is not divorced from the descriptive and taxonomic stages of development, however. While this study will be descriptive in nature, it will certainly not be atheoretical. I will take an abstractive approach to delineating relationships in my analysis. My approach to the development of an analytic system will be through factor analysis and linear algebra.

### III. FOREIGN CONFLICT BEHAVIOR

The study of international conflict is not limited to any one discipline. Scholars of almost every disciplinary background have analyzed international conflict. A basic distinction is discernible within this group, however. Those who have approached international conflict from the psychological or sociological disciplines have assumed that conflict represents an abnormal type of behavior much like a mass mental sickness, (Pear, 52; Grace, 23; Mead, 45; Allport, 2; Freud, 21; and James, 35). Political scientists and systems theorists have more often tended to look at conflict as representing normal interaction in the face of competing goals on the part of nations (Snyder and Paige, 80; Organski, 52; Wright, 52; Boulding, 6; McClelland, 40; and Schelling, 71).

This analysis will follow the latter attempts by defining conflict behavior as "opposition among social entities directed against one another..." (Wright, 92, p. 146), and as "an adjustment process in which, as opposing energy systems meet, the energy of each is directed against the other to

remove, dominate, or destroy it..." (Carr, italics omitted, 12, p. 301). I will make the distinction between several common components of conflict: there appears to be a situation in which two or more parties direct their energy at each other's expense (Rummel, 62, p. 4).

Since "conflictual behaviors are those designed to destroy, injure, thwart, or otherwise control another party or other parties..." (Hack and Snyder, 44, 218), one should be able to measure each behavior in terms of specific acts (e.g., attacks or warnings) or occurrences reflecting the aggregation of such attacks (e.g., war). These acts are considered to be dyadic; that is, they originate in one nation and are directed at another. Examples of such dyads are the United States to North Vietnam, Soviet Union to China, Israel to Jordan, and Jordan to Israel.

The focus of my interest in conflict is on interaction--on the interplay of conduct --- and, therefore, on social process much more than on observed or attributed traits of the actors. In the terminology now rising in the international relations field, McClelland, 40; Rosenau, 59; Singer, 72; Snyder, 79; and Sonderrmann, 82, the emphasis is on the workings of the international conflict system more than on the analyses of foreign policies. I wish to bring into focus a large number of the aspects, modes and functions of international political communications. Others have suggested approaches for analyzing this international conflict system. Boulding, 6, for example, has sketched a static model of competition within which he locates the concept of conflict. Parties to conflict are identified, the "positions" of parties in a behavior space are conceptualized, and conflict is defined "as a situation of competition in which the parties are aware of the incompatibility of potential future positions, and in which each party wishes to occupy a position which is incompatible with the wishes of the other" (p. 5). The result is the

identification of the indifference area (or "set"), the conflict area, and the trading or bargaining area. Boulding's next step is to sketch in a dynamic model. This extension of his static model borrows heavily from Richardson processes and classical mathematics. The research proposed here will investigate a dynamic extension similar to Boulding's but employing linear algebra and factor analysis.

Boulding's thought provoking piece is especially applicable in the current period of international politics. The post World War II period has produced a great deal of conflict. This behavior between nations has tended to cloud the clear distinction between peace and war. Throughout this period, several situations have exhibited quasi-peace alternating with quasi-war relationships; Indian-Pakistan and Arab-Israeli relations provide precise examples of this quasi-peace-war cycle. The Soviet Union and the United States have also experienced these fluctuations in certain places during certain time periods.

Current research efforts have concentrated quite heavily upon the topic of conflict behavior. Previous work has provided a good deal of information about conflict in the international system over time (Singer and Small, 73; Denton and Phillips, 18; Wright, 93; Richardson, 55; Moyal, 48; and Rosecrance, 58), between select pairs of nations over time (McClelland et al, 42; McClelland, 41; North et al, 50; Whiting, 91; and Smoker, 76; or for all nations at a single point in time (Rummel, 66; and Tanter, 85). While the preceding analyses have only begun to scratch the surface, another area of concern seems quite compelling. In order to develop a theoretical model accounting for changes in conflict relations over time and to analyze the conflict behavior of all nations, I will attempt to combine the longitudinal approach of the case studies, (Smoker

and McClelland) with the all inclusive approach of Rummel and Tanter. When one is dealing with conflict as an interactive exchange between nations both of which are attempting to achieve mutually incompatible goals (Boulding, 6, p. ), a time slice as short as possible would be desirable. I plan to look at the total range of conflict behavior over all conflict dyads for a series of consecutive points in time.

By adopting this approach, I reject the notion that international conflict can be measured by a single indicator such as the number killed. Such indicators represent only aspects of conflict, although important ones. I will be looking for the dimensions of conflict that are found to be independent of each other. I am searching for the smallest number of dimensions that accurately describe the variety of conflict behavior between nations over 12 monthly periods. Given the difficulty of using single variable indicies for any one concept, i.e. poor data with unknown sources of error -- random and systematic -- and validity problems of the definitions, students of international relations are faced with the situation similar to Heisenberg's indeterminacy principle in quantum physics. We cannot measure the precise position of "change" of a nation in the system. Instead, we might move to methods that deal with probability densities -- that define stable structure among arrays of attributes and behavior. In these areas where several variables tend to provide dense clusters of information we are most likely to find the best measures for describing international relations.

This approach to empirical concept formation is associated with factor analysis. Hall and Rummel have analyzed the conflict behavior of all nations in 1963, 27. When they considered 1963 as a single time slice, they found five dimensions of dyadic foreign conflict behavior.



Grouping nations by types is a basic step in describing phenomenon and building a science. By establishing types, we simplify reality and increase our ability to explain phenomena. Our types are boundaries defining different groups of conflict relationships. Students of international relations have always dealt with nation types. The problem with prevailing types, however, is that the rationale underlying categorization is often not explicit.<sup>5</sup> My approach will be to define the similarities among nation dyads in terms of their location in the space of the dimensions of dyadic conflict behavior and to delineate the profiles of each group's behavior on the basic dimensions. In the methodological section I will develop a methodology for providing profiles of dyadic behavior.

In the preceding I have established the relationship of this study to previous analysis of conflict. I have also laid out the theoretical questions which guide the analysis, which in summary are:

- (1) what are the dimensions of variation among nations with respect to their dyadic conflict behavior over a continuous series of months,
- (2) what is the relationship of these dimensions to the yearly dimensions found by Hall and Rumel; (3) what are the groups of nation dyads that exhibit similar conflict behavior over time; and (4) what are the profiles of each group's conflict behavior? What follows is a description of the data to be analyzed and the methodology that will be employed.

#### IV. DATA

The conflict data have been collected from the daily New York Times using the foreign conflict code sheet given in Rumel, 63. The data were collected by actors, object, date, and type of conflict act or actions. Figure 1 presents the code sheet.

22-23  
Unlabeled  
Violence

Act →

24 Unlabeled = 1	25 Assault = 1	26 Unlawful Anti-Fur Pacts = 1	27 Attack on Embassy = 1	28 Attack on Embassy or Equipment = 1	29 Attack on Flag = 1	30 Attack on Other Official Property = 1	31 Attack on Private Property = 1	32 Attack on Civilians = 1
33 Attack on Military Personnel = 1	34 Cross-Border Hostility = 1	35 Cross-Border Tribal Warfare = 1						

Attack Methods →

36 Unlabeled = 1	37 Hand = 1	38 Fire = 1	39 Bombing = 1	40 Stinging = 1	41 Firearms = 1	42 Molotov, Rocks, Bottles, etc. = 1	43 Heavy Armament = 2
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22-23  
Unlabeled  
Violence

Numbers →

44 Involved = 0	45 Involved = 1	46 Involved = 2	47 Involved = 3	48 Involved = 4	49 Involved = 5	or, if no exact data → on involved	
50 Involved = 0	51 Involved = 1	52 Involved = 2	53 Involved = 3	54 Involved = 4	55 Involved = 5		

Killed

56 Killed = 0	57 Killed = 1	58 Killed = 2	59 Killed = 3	60 Killed = 4	61 Killed = 5	or, if no data on killed → or wounded	
---------------------	---------------------	---------------------	---------------------	---------------------	---------------------	---	--

22-23  
Unlabeled  
Violence

Casualties

62 Casualties = 0	63 Casualties = 1	64 Casualties = 2	65 Casualties = 3	66 Casualties = 4	67 Casualties = 5	or, if no data on killed → or wounded	
-------------------------	-------------------------	-------------------------	-------------------------	-------------------------	-------------------------	---	--

70  
casualty data  
for actor  
= 0

71  
casualty data  
for both  
participants  
= 1

72  
casualty data  
for all  
participants  
= 2

22-23  
Non-Violent  
Behavior

Act →

24 Unlabeled = 0	24 Boycott = 1	24 Protest Rally = 2	24 Anti-Foreign Demonstration = 3	24 Unlawful Anti- Foreign Demon. = 4
------------------------	----------------------	----------------------------	--	---

Numbers →

24 Involved = 0	25 Involved = 1	26 Involved = 2	27 Involved = 3	28 Involved = 4	29 Involved = 5	or, if no exact data → on involved	
-----------------------	-----------------------	-----------------------	-----------------------	-----------------------	-----------------------	--	--

22-23  
Unlabeled

Description  
of Unlabeled →  
Act

74  
Comments  
Qualifications on  
Any Official Act  
Unlabeled Acts  
Above

Unlabeled Acts

# FOREIGN CONFLICT DATA CODE SHEET

1 2 3 Actor	4 5 6 Object	7 8 Day	9 10 Month	11 12 13 14 Year	15 16 17 Data Collector	18 19 20 Source	21 = 0 Complete Data	21 = 1 Incomplete Data
<input type="checkbox"/> Data on Both Sides		<input type="checkbox"/> Data on One Side						

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November, 1964, Revision  
R. J. Rumsa

22:23 <input type="checkbox"/> = 01 Written or Defense	Act →	25:26 <input type="checkbox"/> = 01 Unclassified	25:26 <input type="checkbox"/> = 04 Abuse	25:26 <input type="checkbox"/> = 02 Mobilization	27:28 <input type="checkbox"/> = 03 Minors	25:26 <input type="checkbox"/> = 04 Military Minors	25:26 <input type="checkbox"/> = 05 Small Military	25:26 <input type="checkbox"/> = 06 Street Military			
	Act →	25:26 <input type="checkbox"/> = 06 Unclassified	25:26 <input type="checkbox"/> = 01 War	25:26 <input type="checkbox"/> = 02 Continuous Military Action	25:26 <input type="checkbox"/> = 03 Discrete Military Action	25:26 <input type="checkbox"/> = 04 Clashes	27:28 <input type="checkbox"/> = 05 No of military clashes	29 <input type="checkbox"/> = 0 10/99	29 <input type="checkbox"/> = 1 10/99	29 <input type="checkbox"/> = 2 10/99	
	Duration →	30 <input type="checkbox"/> = 0 ≤ Day	30 <input type="checkbox"/> = 1 ≥ Day	31 32 33 34 <input type="checkbox"/> = 0 Days	35 <input type="checkbox"/> = 0 1 to 9 Days	35 <input type="checkbox"/> = 1 10 to 99 Days	35 <input type="checkbox"/> = 2 100 to 999 Days	35 <input type="checkbox"/> = 3 ≥ 1000 Days			
	Forces Involved →	36 <input type="checkbox"/> = 0 Unclassified	36 <input type="checkbox"/> = 1 Army	36 <input type="checkbox"/> = 2 Navy	36 <input type="checkbox"/> = 3 Air Force	36 <input type="checkbox"/> = 4 Army- Air Force	36 <input type="checkbox"/> = 5 Army- Navy	36 <input type="checkbox"/> = 6 Air Force- Navy	36 <input type="checkbox"/> = 7 Air Forces	36 <input type="checkbox"/> = 8 Unknown- total	
22:23 <input type="checkbox"/> = 03 Unplanned Violence	Personnel Involved →	37 38 39 40 41 42 43 44 <input type="checkbox"/> = 0 1 to 9	45 <input type="checkbox"/> = 0 1 to 9	45 <input type="checkbox"/> = 1 10 to 99	45 <input type="checkbox"/> = 2 100 to 999	45 <input type="checkbox"/> = 3 1000 to 9999	45 <input type="checkbox"/> = 4 10000 to 99999	45 <input type="checkbox"/> = 5 ≥ 100000			
	22:23 <input type="checkbox"/> = 01 Unplanned Violence	46 <input type="checkbox"/> = 0 personal data for actor	46 <input type="checkbox"/> = 1 for both participants	46 <input type="checkbox"/> = 2 for all participants	47 48 49 50 51 52 <input type="checkbox"/> = 0 Killed	53 54 55 56 57 58 <input type="checkbox"/> = 0 Wounded	59 <input type="checkbox"/> = 0 Killed	59 <input type="checkbox"/> = 1 10 to 99	59 <input type="checkbox"/> = 2 100 to 999	59 <input type="checkbox"/> = 3 1000 to 9999	59 <input type="checkbox"/> = 4 10000 to 99999
22:23 <input type="checkbox"/> = 03 Negotiation	Casualties →	67 <input type="checkbox"/> = 0 casualty data for actor	67 <input type="checkbox"/> = 1 for both participants	67 <input type="checkbox"/> = 2 for all participants	25:26 <input type="checkbox"/> = 04 Explosion or Bombing	25:26 <input type="checkbox"/> = 05 Explosion or Bombing	25:26 <input type="checkbox"/> = 06 Explosion or Bombing	25:26 <input type="checkbox"/> = 07 Explosion or Bombing	25:26 <input type="checkbox"/> = 08 Explosion or Bombing	25:26 <input type="checkbox"/> = 09 Explosion or Bombing	
	Act →	25:26 <input type="checkbox"/> = 09 Unclassified	25:26 <input type="checkbox"/> = 01 Secret Dipl. Relations	25:26 <input type="checkbox"/> = 02 Secret Dip. Relations	25:26 <input type="checkbox"/> = 03 Secret Econ. Relations	25:26 <input type="checkbox"/> = 10 Diplomatic Refusal	25:26 <input type="checkbox"/> = 11 Discontinue Aid	25:26 <input type="checkbox"/> = 12 Discontinue Receiving Aid	25:26 <input type="checkbox"/> = 13 Abrogate Treaty or Agreement	25:26 <input type="checkbox"/> = 14 Other Acts	
	25:26 <input type="checkbox"/> = 15 Discontinue Negotiations	25:26 <input type="checkbox"/> = 16 Cancel Official Visit	25:26 <input type="checkbox"/> = 17 Seize Official Property	25:26 <input type="checkbox"/> = 18 Confiscate or Loot	25:26 <input type="checkbox"/> = 19 Confiscate or Loot	25:26 <input type="checkbox"/> = 20 Add to Subversive or Radical Group	25:26 <input type="checkbox"/> = 21 Milit. Aid to Opp. or Violent Enemy				
	Major Theme →	25 <input type="checkbox"/> = 0 Unclassified	25 <input type="checkbox"/> = 1 Assassination	25 <input type="checkbox"/> = 2 Representation	25 <input type="checkbox"/> = 3 Eviction	25 <input type="checkbox"/> = 4 Warning	25 <input type="checkbox"/> = 5 Threat	25 <input type="checkbox"/> = 6 Ultimatum	25 <input type="checkbox"/> = 7 Investigation of Cause under Art. 35	25 <input type="checkbox"/> = 8 Demand for Compensation	
22:23 <input type="checkbox"/> = 06 Written Communication	Content	27:28 <input type="checkbox"/> = 0 Unclassified	29:30 <input type="checkbox"/> = 01 Warning	31:32 <input type="checkbox"/> = 02 Threat	33:34 <input type="checkbox"/> = 03 Demand for Compensation	35:36 <input type="checkbox"/> = 04 Assassination or Provocation	37:38 <input type="checkbox"/> = 05 Assassination or Violent Action	39:40 <input type="checkbox"/> = 06 Act(s) of Violence or Aggression	41:42 <input type="checkbox"/> = 07 Act(s) of Violence or Aggression	43:44 <input type="checkbox"/> = 08 Act(s) of Violence or Aggression	
	Minor Themes →	45:46 <input type="checkbox"/> = 09 of Aggressive Policies	47:48 <input type="checkbox"/> = 10 of Territorial Ambitions	49:50 <input type="checkbox"/> = 11 of Self- defense	51:52 <input type="checkbox"/> = 12 of Internal Interference	53:54 <input type="checkbox"/> = 13 of Dynamic Methods	55:56 <input type="checkbox"/> = 14 of Instability or Instability	57:58 <input type="checkbox"/> = 15 of Instability or Instability	59:60 <input type="checkbox"/> = 16 of Responsibility for Violence or Conflict		
22:23 <input type="checkbox"/> = 07 Oral Communication	Source →	62 <input type="checkbox"/> = 0 Unclassified	62 <input type="checkbox"/> = 1 Chief of State	62 <input type="checkbox"/> = 2 Cabinet Member or High Official	62 <input type="checkbox"/> = 3 Ministry	62 <input type="checkbox"/> = 4 Government	62 <input type="checkbox"/> = 5 Spokesman	62 <input type="checkbox"/> = 6 UN Rep. representative	62 <input type="checkbox"/> = 7 Official Media	62 <input type="checkbox"/> = 8 Ambassador	62 <input type="checkbox"/> = 9 Unknown
	Context →	61 <input type="checkbox"/> = 0 Unclassified	61 <input type="checkbox"/> = 1 Diplomatic Note	61 <input type="checkbox"/> = 2 Letter	61 <input type="checkbox"/> = 3 Communique	61 <input type="checkbox"/> = 4 Interview	61 <input type="checkbox"/> = 5 Interview	61 <input type="checkbox"/> = 6 Interview	61 <input type="checkbox"/> = 7 Interview	61 <input type="checkbox"/> = 8 Interview	61 <input type="checkbox"/> = 9 Unknown
22:23 <input type="checkbox"/> = 08 Written or Oral Communication	Destination →	66 <input type="checkbox"/> = 0 Unclassified	66 <input type="checkbox"/> = 1 Internal Communication	66 <input type="checkbox"/> = 2 Internal Communication	66 <input type="checkbox"/> = 3 UN Sec. Council	66 <input type="checkbox"/> = 4 UN Sec. Assembly	66 <input type="checkbox"/> = 5 UN Rep. representative	66 <input type="checkbox"/> = 6 UN Rep. representative	66 <input type="checkbox"/> = 7 UN Rep. representative	66 <input type="checkbox"/> = 8 UN Rep. representative	66 <input type="checkbox"/> = 9 Unknown

11b :

Directed Dyads	Behavior						
	Clashes	Days of Violence	Planned Violent Acts	Negative Acts	Diplomatic rebuffs	Warnings	Anti-foreign acts
Albania-Greece							
Albania-Italy							
Albania-USA							
Argentina-Brazil							
Argentina-Paraguay							
.							
.							
.							
Syria-Turkey							
Syria-U. Kingdom							
.							
.							
.							
Yugoslavia-U. Kingdom							
Yugoslavia-USA							
Peace dyad							

Figure 11

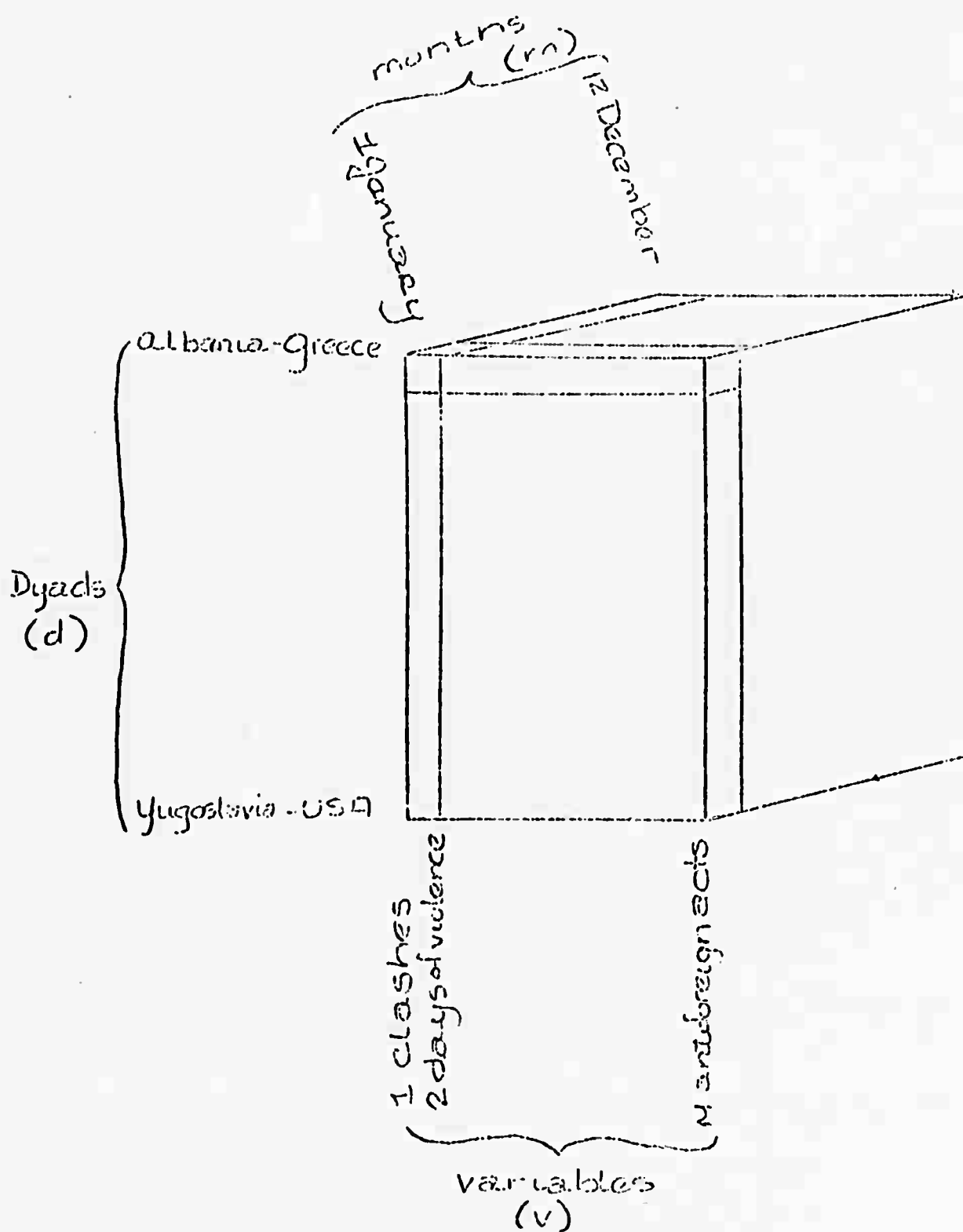


Figure III

The data were used to analyze dyadic conflict behavior of 1963 (Hall and Rummel). Figure II presents the form of the matrix of data which was analyzed in that work. It should be clear that the results of factor analyzing this matrix will refer to patterns of conflict behavior of nations directed toward other nations. There were 275 dyads exhibiting conflict behavior in 1963. We will employ all 275 dyads in this study and make use of the data collected by Rummel. The data will be reorganized from the frequencies for the one year employed in the previous study to a month-by-month aggregation. These data will then be screened to determine what categories have a sufficient frequency of occurrence for the analysis. Once the categories have been determined, the data matrix of Figure II will be one of twelve slices that will be used in the current project. The result of data organization will be a cube of dimensions M number of variables across 275 dyads, twelve months deep. Figure III presents the form of the cube to be analyzed.

Two questions are pertinent at this point:

- 1) Why have months been chosen as the time frame? and
- 2) Is the New York Times a sufficient source of information?

I have chosen months rather than weeks or days as a time frame because there are not enough conflict events reported in the New York Times in a day or week. The matrix that would result for each week would contain too many zero cells. Since I am interested in the diplomatic aspects of conflict -- the give and take of international bargaining and negotiation -- I will want to concentrate on as small a time frame as my data will allow. A monthly period seems to be appropriate in this case.

Turning to the reliability problem associated with the use of a single newspaper, I do not consider that the New York Times provides accurate frequency counts of the amount of conflict between any two nations. In fact I assume the frequency of conflict acts to be an understatement in most cases. Thus, the number of warnings and defense acts between Israel and Jordan may not reflect the actual quantities in a given month. I do consider the source as presenting an accurate pattern of occurrences for each variable over the dyads in this study, however. The correlation coefficient that will be the initial measure of similarity employed in this research, measures the pattern similarity of values for two conflict variables and not the magnitude similarity. Thus if two variables measuring conflict behavior have the same pattern, they will be perfectly correlated. Figure IV depicts this relationship.

In addition to variables measuring conflict behavior, two other types of variables will be employed to help in discussing the dimensions of dyadic conflict behavior. Time fluctuations will be measured by four time variables. The first will have a one in all entries for January, a two for February, and so on through a 12 for the December observations. Another time variable will be the log of time, the third will be the result of a quadratic equation that should measure whether conflict is more (or less) frequent in the summer months. A fourth will form a sine function. A check of variables which load with these time functions will provide descriptive information as to trends in conflict behavior.

Error in conflict data can be of two types: random or systematic. If random error were present, the correlations between variables would be reduced below what they would be without such errors. That is, a significant correlation between data that one suspects to contain a lot of

magnitude

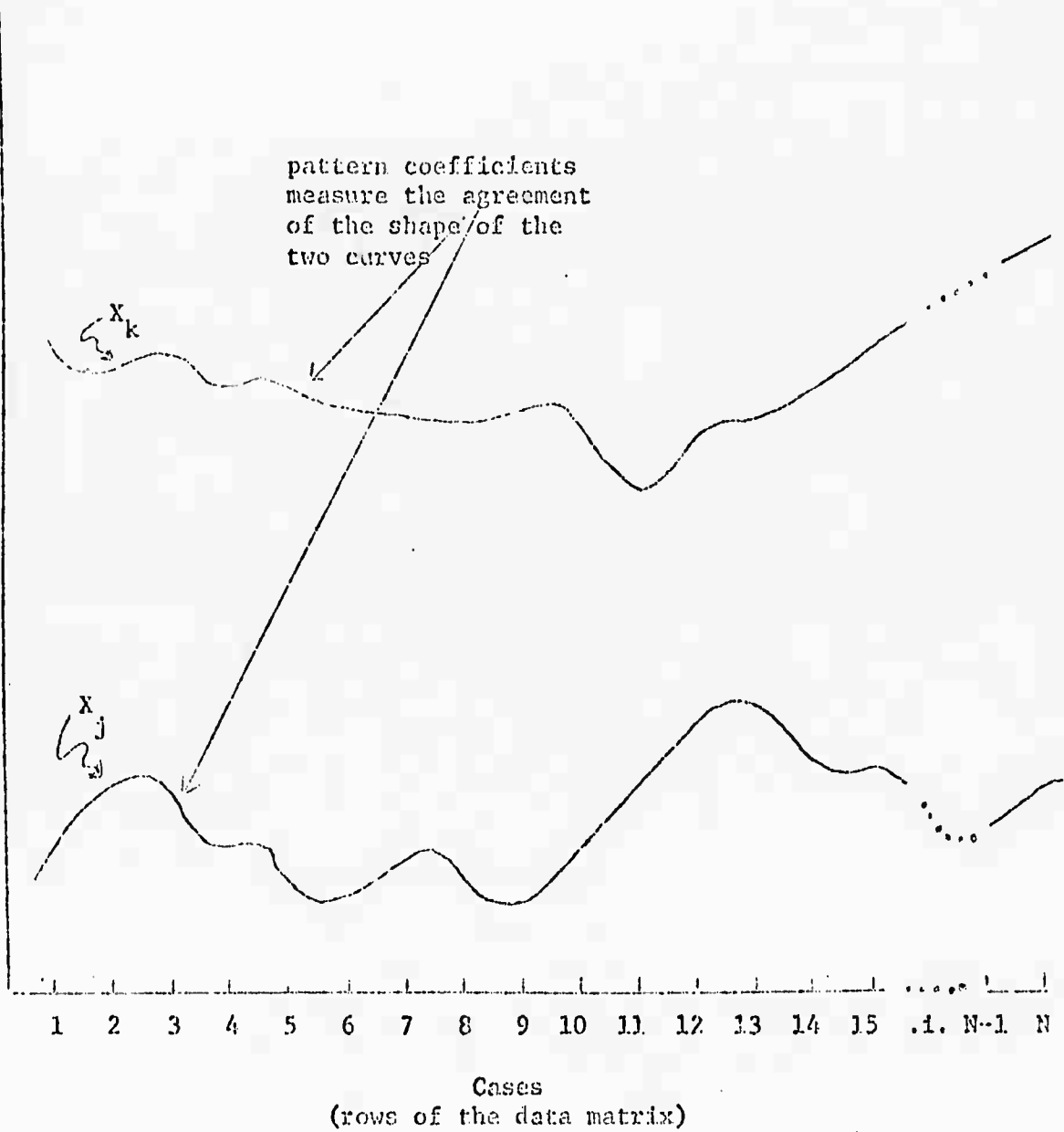


Figure IV



random "noise" can be considered even more significant than if one were dealing with uncontaminated data.<sup>6</sup> The impact of such error on the results of factor analysis would be to lower somewhat the loadings that the variable have on the factors, but not to distort the factor structure as a whole.<sup>7</sup> I will include a variable of random numbers, chosen from a random number table in my analysis. The results of factor analyzing a matrix that includes this variable would provide two bench marks in interpreting the general results. If, for instance, the random variable has a loading of .250 on a factor, then all loadings less than or near that should be considered as questionable. The loadings might be the result of random error alone. By looking at the communality of the random variable across all factors, the researcher is faced with a similar problem. The variance accounted for in factor analyses of variables with communalities similar to the random variable may be due to random variance alone.

Systematic error is that correlated with either the error or true values of the other variables. The result may be overly high or low correlations and factors with little accuracy. Three separate variables will be included to check on systematic error. The embassies and legations in both nations in the dyad will be used as a measure of world interest of that dyad. The mean energy consumption per capita of a dyad will be included as a measure of the joint economic development of the dyads. And thirdly, a measure of censorship in A and B will be included to check on the likelihood of difference in the reporting of conflict behavior between dyads about which information is difficult to acquire. Other studies have made similar attempts at ascertaining the effect of systematic error and have used the high loadings of the systematic error variables as bench marks when interpreting the factors (Rummel, 64 and Tanter, 85).

One other procedure will be carried out in order to facilitate comparisons of the results of this project with other analysis. In addition to the 290 dyads that have conflict in 1963, we will add one more dyad. This dyad will have zero's for all conflict variables, thus representing dyads without any conflict behavior, i.e., "peace." The peace dyad will be the null case of conflict. By including such a null case in similar studies, a common point for comparison is provided. The origin of the space spanned by the dimensions of conflict can be set at this point in space so that the origin is invariant from one analysis to another.

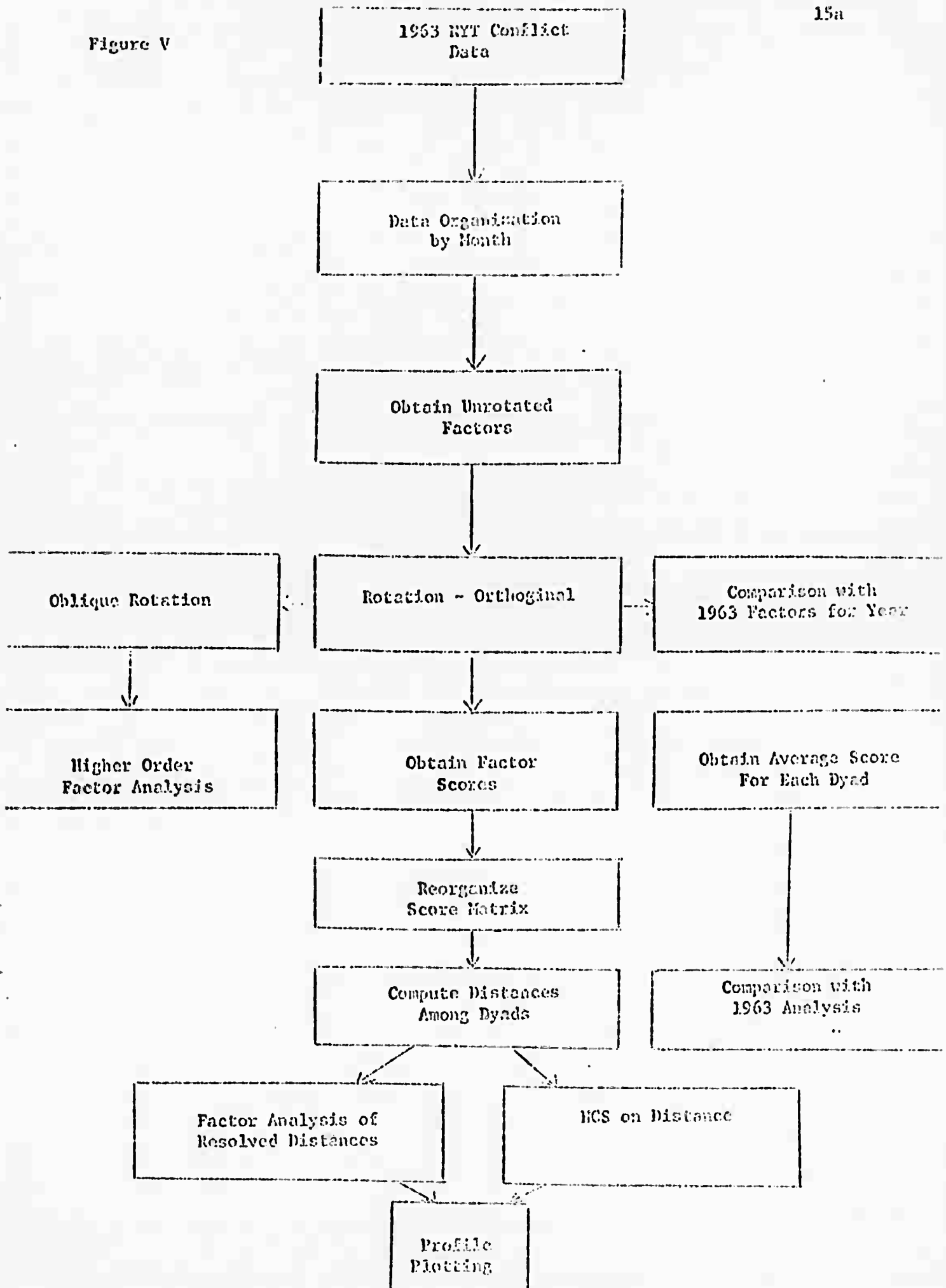
## V. THE RESEARCH DESIGN

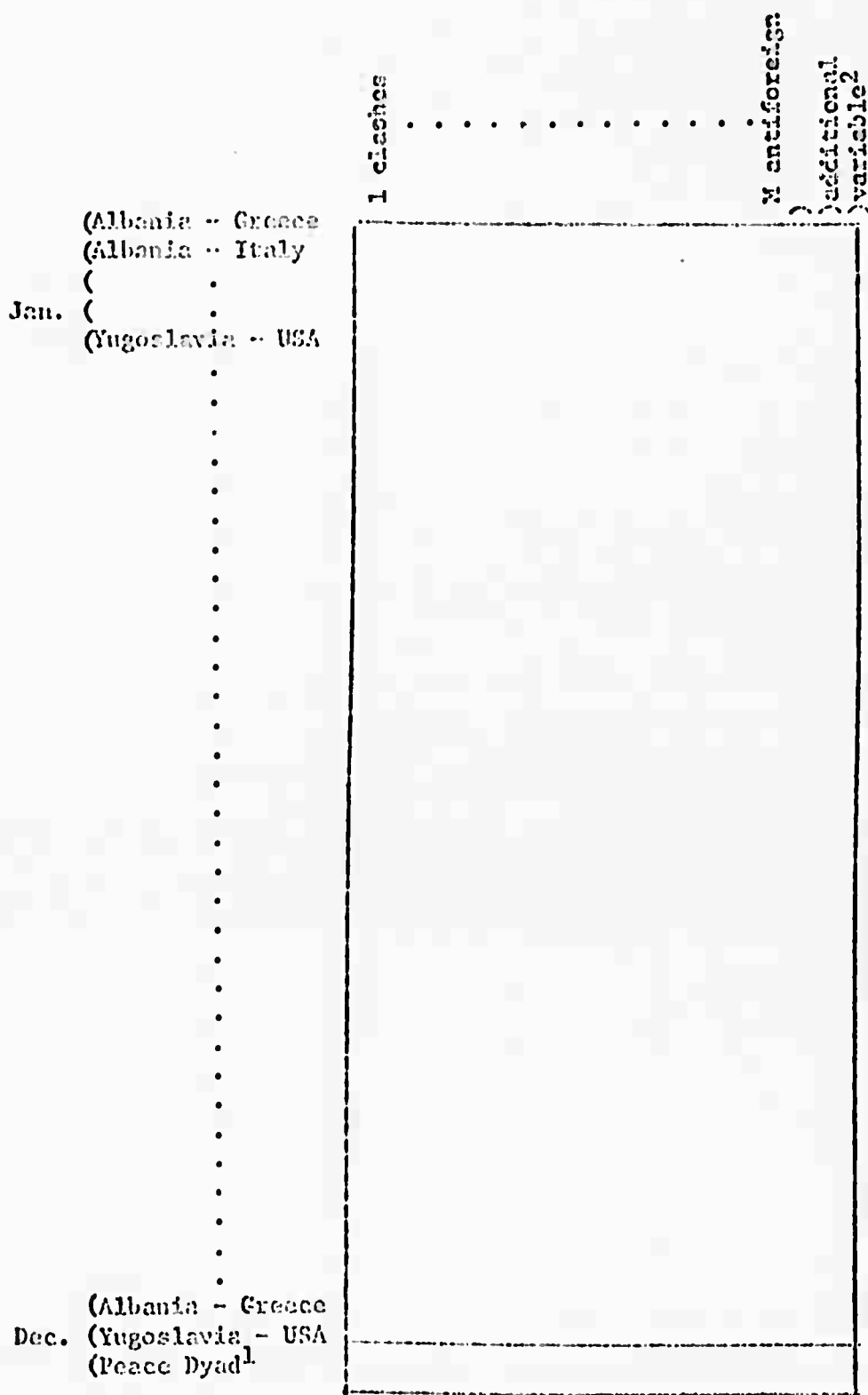
The flow of a research project is along a number of research steps. Each step is a node comprising a particular procedure chosen from among a number of alternatives.

In this section, I will describe the methods in the logical order that they are anticipated to take in the research. Figure V presents a flow chart of the steps to be followed in completing the analysis. Down the center of the chart are the main steps to be followed. It is envisioned that several answers will be derived at different points in the research project. Squares which branch off to the side of the main flow represent answers that are derived in the process of completing the research cycle. The data collection, previously discussed, will result in a data cube. Cattell terms the data cube that I wish to analyze a multifacet matrix (Cattell 13, p.121). The actual matrix envisioned in this project is presented in Figure VI. I have decided to stack the time slices on top of each other. Thus, each month is a dyad by conflict matrix. January, 1963, is the top matrix and December, 1963, is the bottom matrix. In this way, I will have combined both the overtime and across

Figure V

15a





1. An artificial dyad without any conflict behavior. This enables the location of peaceful dyads in the resulting analyses.
2. See text pp. 6 & 7.

Figure VI

dyads analyses into a single matrix. This technique is not new in the social sciences. Cattell, Rummel, and Tucker, have all suggested its use (13, 61, 86, 87). It has been employed as a partial analysis by Tucker upon several matrices of psychological test data. It does not appear to have been tried, however, in international relations.

#### Matrix Notation

Due to the novelty of both this approach and of matrix notation to students of international relations a short discussion of the matrix symbols to be employed in this proposal seems desirable. The figures which follow in the research design will refer mostly to matrices. These matrices will be organized in normal, two-dimensional form of rows and columns. Normally, a matrix is signified by a capital letter, which designates the type of matrix, and small case letters to each side, signifying the meaning placed on rows and columns. Thus:

$$r^M_c$$

would be a matrix: M with rows r and columns c. Figure II, the matrix of the Hall and Rummel study, would be:

$$275^C_{26}$$

or a conflict matrix of 26 variables over 275 dyads. An exception to normal practices will be necessary, in this proposal, however. In several matrices, either the rows or the columns will be organized in such a way as to account for two sides of the data cube. The matrix in Figure VI is an example of such a matrix. In this case, the columns contain rows for all dyads in each of the twelve months. It could be written:

$$(td)^C_v$$

or a conflict matrix of variables over time and dyads. The following table displays the notations most commonly employed in this paper.

TABLE I

## Matrix Notations

F	factor loading matrix
f	a specific factor loading vector
S	factor score matrix
s	a specific factor score vector
t	number of time periods
m	general case for time
d	number of dyads
e	general case for dyads
p	number of factors
l	general case for factors
v	number of variables
$dS(tp)$	matrix of factor scores organized time and factors over dyads
$(td)S_p$	matrix of factor scores organized factors over time and dyads
$vF_p$	matrix factor loadings organized factors over variables

Transformations

Three separate problems will be discussed in this sub-section:

1. What sort of standardization would be adopted?
2. Do we wish to transform any of the data?
3. Which correlation procedure is to be adopted?

1. Standardization. The effect of standardization is to remove all variance from the data associated with differences in means and deviations between variables. There are several potential ways to standardize this matrix. The variables could be standardized within each month. This would equate the means of each month's activities and wash out the magnitude shifts due to crises or other abnormal periods.

Another form of standardization would be to standardize the rows of our matrix. Standardization in this way would equate the mean amount of activity for each dyad. We could then look at differences within

dyads over time. This type of analysis would require that the researcher be confident about the frequencies of each of the conflict variables. This would be too strong an assumption, given our data source. Moreover, the questions being asked of the data are not related to within dyad differences, but rather, to those between dyads, or more appropriately, over all dyads.

A third approach would be to standardize each nation's behavior over the twelve months on a specific variable. This is an appealing standardization procedure as it would reduce the effect of nations which have high frequency of conflict behavior as measured by all variables. This does not happen in conflict behavior, however. Previous analysis has shown that certain nations may be high in some conflict behavior variables but do not display a high frequency of certain other conflict variables. (Young and Marton, 94). My analysis will want to take into account the high occurrence of certain variables for specific dyads.

What remains, then is the possibility of standardizing down the columns of the total matrix and thus equating the means of each variable over all dyads and all time periods. This form of standardization is done by the correlation coefficient to be computed between the variables.

2. Data Transformations. Statisticians working with random samples argue that it is necessary to transform data with highly skewed distribution to more normal distributions. This argument is valid when the researcher is dealing with purely random samples and is attempting to base his judgments on significance tests, where he feels worried about rejecting a true hypothesis.

No data transformation will be applied to the data in this analysis for three reasons. First, I am dealing with the population of conflict dyads for 1963. There is no need to make inferences from random samples.

Secondly, we are interested in describing the behavioral space of conflict behavior over time. We will be interested in describing the percentage of variance in one variable that is related to the variance in another variable, and not in interpreting significance tests. Thirdly, other analyses on 1963 as a single point in time have not transformed their matrix (Hall and Rummel, 27). For us to transform any data in this analysis would make comparisons more difficult.

3. Correlation Procedures. There are several correlation coefficients to choose from for accessing the intercorrelation among the measures. Because the distribution of the conflict data in previous analyses have been non-normal, generally J distributions, and because some of the data will be dichotomous, thought must be given as to which correlation coefficient would provide the most meaningful results. The rank correlation methods were ruled out because of the high number of tied scores which will result in the organization of the matrix. Tetrachoric and phi-over-phi-max are ruled out because of the continuous nature of many of the conflict variables. The product moment coefficient is applicable to both dichotomous and continuous data. Moreover, it was the coefficient chosen in the earlier study of Hall and Rummel. Its use in this analysis would facilitate comparisons.

#### Factor Analysis

The data matrix that we have described to this point will be factor analyzed employing principal component analysis. The principal axis solution will be rotated to orthogonal and oblique solutions.<sup>8</sup> We have chosen component analysis because the specific variance is important in the description of conflict behavior. Previous works have also used component analysis in describing total variance in dyadic conflict behavior (Rummel, 65, and Hall and Rummel, 27).



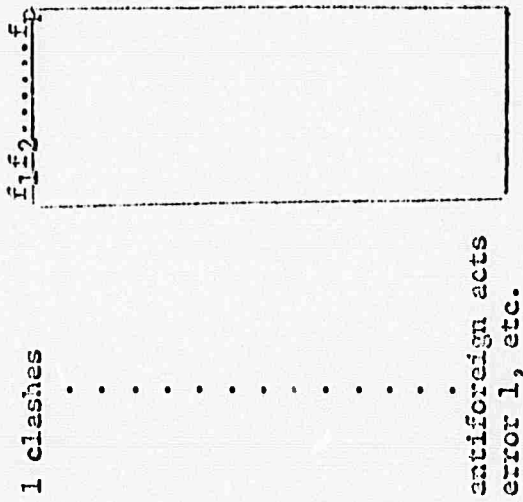
In addition, we plan to employ the factor scores derived from the factors of conflict behavior and the component model will allow better estimates of true factor scores than would common factor analysis :

(Rummel, 61). , Another reason is that earlier work of Rummel's has found that some variables are specific to a single dimension, for example, anti-foreign demonstrations form one dimension in the 1955 dyadic behavioral conflict analysis (Rummel, 65). We would not want to lose these specific factors.

The first matrix which will be derived by factoring our multifaceted grid is a factor loading matrix. The matrix will have all of the variables as rows and the columns will represent each of the factors. Another matrix derived at this point is a factor score matrix. The factor score matrix will have each of the 275 dyads for each of the twelve time periods as its rows and the factors will represent its columns. Figure VII presents the format of these two matrices.

Both the factor loading matrix and the factor score matrix can be compared with earlier work which considered 1963 as a single point in time. The factor loading matrix is directly comparable by canonical analysis.<sup>9</sup> The factor score matrix, however, will have to be reduced so that each dyad is only represented once. This is accomplished by taking a mean for each dyad score for the 12 month periods. This procedure is suggested by Cattell, 14. I will then be able to use a canonical regression program to make comparisons with the 1963 analysis of Hall and Rummel, 27.

Another comparison will be made between the dimensions of conflict analyzed on a monthly basis and the dimensions from the yearly analysis of Hall and Rummel. The relationship between the year and the months can be ascertained by taking each month separately and regressing the yearly



Factor matrix  
 $v^F_p$

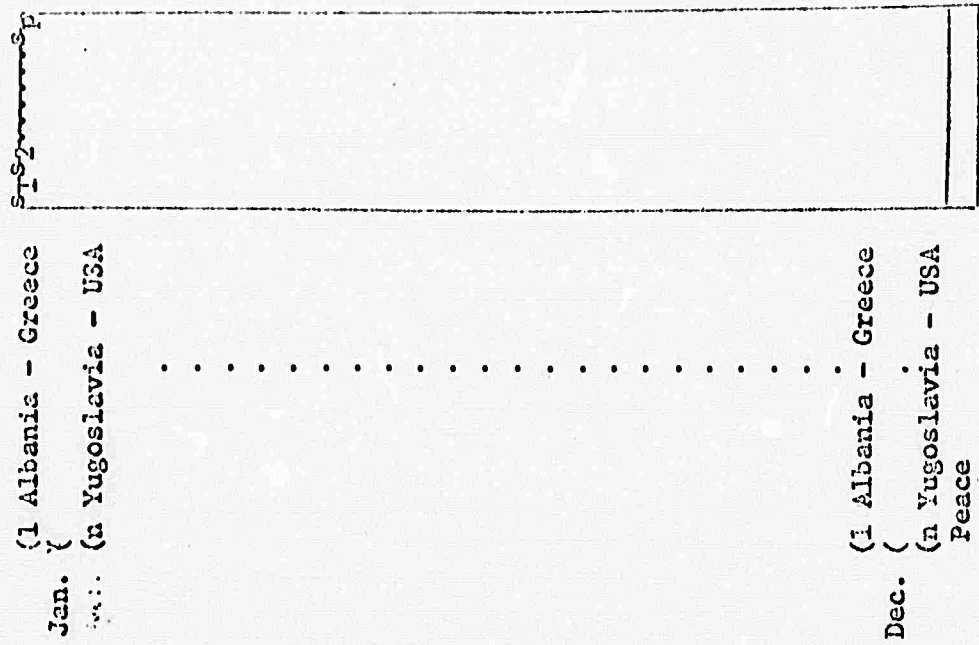


Figure VII

Factor score matrix  
 $(\hat{x}_i)^s_p$

dimensions on to each. The monthly periods that most closely resemble the yearly pattern in 1963 can be ascertained in this manner (Anhavaara and Markkanen, 5).

Many theories in international relations concerning conflict may involve concepts which are more abstract than the dimensions delineated in factor analyses of the form outlined above. Concepts such as economic development, for example, may be related to the nature of political system and domestic conflict at higher levels of abstraction. In factor analysis terms, there is a second order social factor tying together these three dimensions. For example, Rummel finds conformation for rank disequilibrium theories of conflict only at higher levels of analysis (65). Cattell (16, p. 225) mentions personality research agreeing on factors resembling the id, ego, and superego in higher order analysis. Employing this form of analysis in this project, the factor correlation matrix derived in oblique rotation will be re-factored as a higher order factor analysis. The resultant components will permit generalizations about higher level abstractions in dyadic conflict behavior over time.<sup>10</sup>

#### The Grouping of Dyads

The results of the above analyses will include a matrix of factor scores. These scores locate the dyads in foreign conflict space as defined by the dimensions of dyadic conflict. At this stage a very interesting question can be asked of the cases: "How similar are the dyads to each other?"

The first step in grouping dyads will be to reorganize the factor score matrix. The order of the matrix was originally factors over time and dyads:

$(td)^S_p$  where

$S$  = matrix of factor scores

$t$  = no. of time periods

$d$  = no. of dyads

$p$  = factors of conflict

We will want to reorganize this matrix so that it is time and factors over dyads:

$d^S(tp)$

Figure VIII shows this reorganizations process.

The spacial location of our population of 275 dyads as a point in the space of conflict dimensions and time is given by their component scores presented in Figure VII. The next step will be to define an indicator of closeness or distance of each of these points in this space from all of the other points.

The Euclidian distance measure has gained a good deal of support as a similarity measure (Cronbach and Glaeser, 17; Nunnally, 51; Rumel, 60.) It measures both elevation (profile average) and scatter (profile standard deviation) similarity as well as similarity in profile shape. Thus, it determines precisely the congruence of spatial locations. The distance measure is:

$$d = \sqrt{\sum_{fm=1}^p (S_{fmB} - S_{fmA})^2}$$

where

$S_{fmB}$  = dyad B's scores on a factor (f)  
for a given month (m)

$S_{fmA}$  = dyad A's score on the same  
factor and month

Jan.  
(1 Albania - Greece  
(n Yugoslavia - USA

$f_{11} f_{12} \dots f_{1p}$
------------------------------

Dec.  
(1 Albania - Greece  
(n Yugoslavia - USA  
Peace

Figure VIII

Reorganized S Matrix

$F_1$		$F_p$	
$M_1$	$M_2$	$M_1$	$M_2$
$M_3 \dots M_{12}$		$M_3 \dots M_{12}$	
1 Albania - Greece			
n Yugoslavia - USA			

Factor score matrix

$(td)^s_p$

$p$  = number of factors

$f_m$  = that portion of a factor for a given month.

See organization of this matrix in Figure VIII.

We will present two methods of grouping matrices on their distances.<sup>11</sup>

The first method is a direct factor analysis of the distance matrix (Rummel, 61, Section 22.2). Although most texts on factor analysis have not dealt with the technique's applications in grouping cases in this manner, its use is well within the factor model and has some support in international relations (Hall and Rummel, 27; Rummel, 60; and Russett, 69). The distances are first scaled to lie between 0 and 1.00, where 1.00 is the closest point in space. This transforms the distance matrix into a similarity matrix. The similarity matrix is then factor analyzed as though it were a correlation matrix. The resulting factors define dyads whose pattern of distances from other dyads are interdependent--similar in profile. Dyads with high loadings on the same factors are similarly located in space: they form a group. The group factors can then be rotated through orthogonal and oblique solutions to delineate the best simple structure definition of groups. These groups would be distinct and without ambiguity as to the number of groups or their membership.

Another method of grouping entities is based upon the actual distance between points in space rather than the patterns of variation in distance associated with factor analysis. This method develops a hierarchical grouping of dyads -- a taxonomic tree or dendrogram with the dyads that are closest in space on the bottom of each branch. This method is closely associated with taxonomic analysis in the biological sciences as employed in building taxonomies of reptiles, mammals, or insects (Sokal and Sneath, 81). Figure IX shows a typical dendrogram.

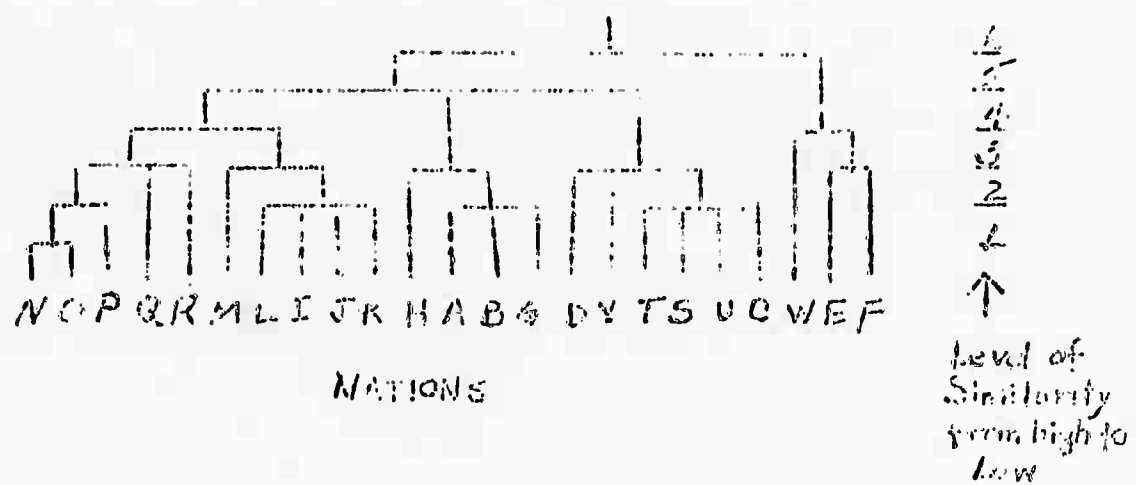


Figure IX

Several techniques by which a dendrogram can be built have been published. The most recent of them is by S. C. Johnson, 36. It subsumes Ward's, 88, grouping technique and that employed by Sokal and Sneath, 81. The technique operates on a distance or similarity matrix. It groups objects on the basis of their distances from each other. Thus, the closest two points in space will be grouped together first. The next closest dyads are grouped secondly, and so forth, until all entities are in a single group. The key to the method is being able to replace two or more objects (dyads) with a single entity or cluster that defines the distance between the newly formed cluster and all other dyads or clusters. When two dyads form a group, there are two alternative distances between the group and the other entities: the original distances between each of the two dyads that joined to form the group and the other dyads. Johnson's program allows the choice of either the maximum distance or the minimum distance. He terms these alternative choices the diameter and connectedness methods, respectively. The resulting taxonomies are invariant under monotone transformations of the similarity data. The absolute numbers obtained from earlier analysis (i.e., distance or similarity calculations) may lie along virtually any scale as long as we have confidence in our data up to rank order.

The diameter method attempts to minimize the diameters of the group. Thus, the diameter method builds groups by adding a dyad to a group if the maximum distance between the dyad and any group member is smaller than that between the group members and other dyads not in the group. Every time a group is formed between two dyads, X and Y, there is a choice as to which distance we should use to represent the distance for each group  $[X,Y]$  and another dyad Z. The diameter method makes the choice of the



maximum distance:

$$d([\bar{X}, \bar{Y}], Z) = \max d[(X, Z), d(Y, Z)]$$

where

$d$  = distance

$[\bar{X}, \bar{Y}]$  = cluster formed by grouping nations  $X$  and  $Y$

$Z$  = another nation not grouped in  $[\bar{X}, \bar{Y}]$

The connectedness method adds a dyad to a group if the minimum distance between this dyad and any member of the group is smaller than that between the group and other dyads, not in the group. In its choice of distances between the group and other dyads, the criteria employed is the minimum distance:

$$d([\bar{X}, \bar{Y}], Z) = \min d[(X, Z), d(Y, Z)]$$

where

$d$  = distance

$[\bar{X}, \bar{Y}]$  = cluster formed by grouping nations  $X$  and  $Y$

$Z$  = another nation not grouped in  $[\bar{X}, \bar{Y}]$

### Profiles of Dyadic Conflict Behavior Over Time

It is difficult to make sense out of groups, such as those envisioned on page 21, without having some description of the profile similarity of group members. We will be interested in characterizing a group of a given size by a taxonomic method developed by Hall, 26. To tell the underlying profile similarity of each group, we compute group averages and standard deviations for each of the columns in our transposed factor matrix as presented in Figure VII. The matrix is organized as:

$$d^S(tp)$$

we then plot these averages and standard deviations on a graph in terms of the average in standard scores for the indicators themselves. Thus, for every column in the matrix, we will be comparing the group mean with the population mean. The resultant graph for each group is exemplified in Figure X. A second means of displaying dyad shifts over time is to take the highest loading nation on each of the factors in the direct factor analyses which produced groupings. Thus, we have the most representative dyad for each of the groups. We can then plot this dyad's shift in conflict behavior by considering two dimensions of conflict behavior at a time and locating the scores for each of these representative dyads on each of the 12 time periods. An example of this form of output is presented in Figure XI.

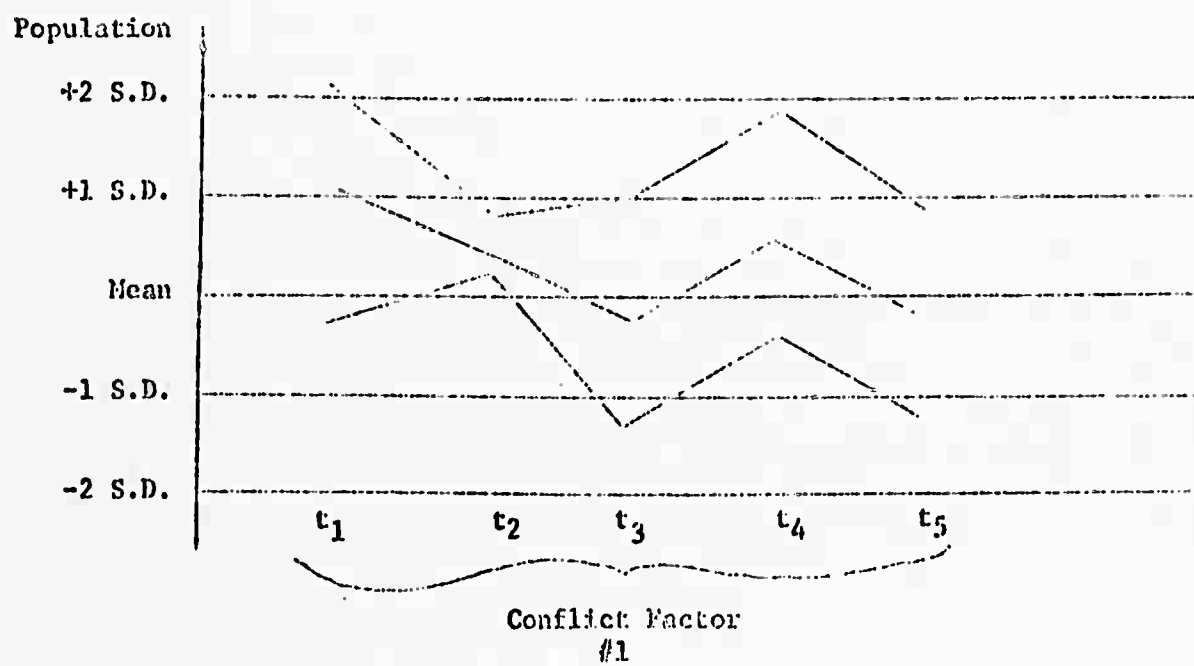
Profile Plot

Figure X

Conflict  
Factor #1

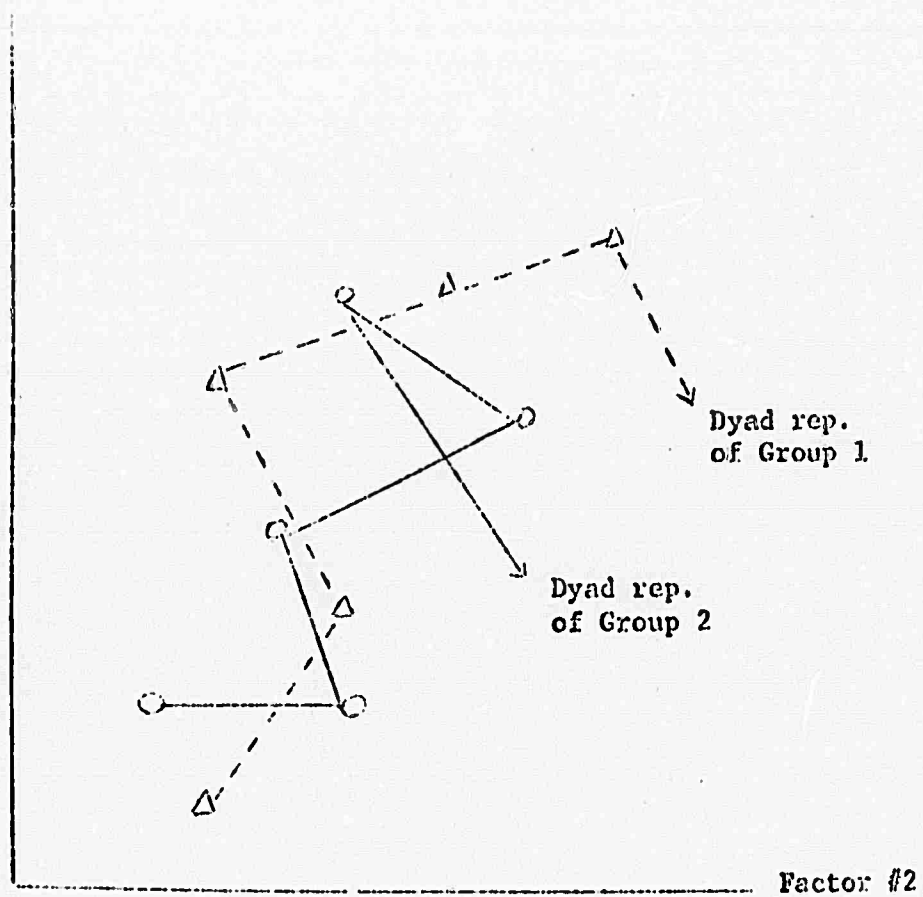


Figure XI

#### Footnotes

1. See: a. J. David Singer, "The Relevance of the Behavioral Sciences to the Study of International Relations," Behavioral Science VI (October 1961) pp. 324-335;
- b. Karl Deutsch, Nerves of Government, Free Press, New York, 1963;
- c. Charles McClelland, "The Function of Theory in International Relations," Journal of Conflict Resolution, IV (September 1960) pp. 303-336.
- d. John G. Kemeny, "A Philosopher Looks at Political Science," Journal of Conflict Resolution, IV (Sept. 1960) pp. 292-301.

The relevance of the scientific inquiry is still debated, however. The most relevant explosions seem to be the exchange between Bull and Kaplan in World Politics and the forthcoming Rosenau and Knorr reader, Contending Approaches to the Study of International Relations.

2. See: a. K. J. Holsti, International Politics, 1967, Prentice Hall, Englewood Cliffs, N. J.
- b. C. A. McClelland, Theory and the International System, MacMillan, 1966, New York.
- c. Harold Sprout and Margaret Sprout, Foundations of International Politics, Van Nostrand, New York, 1962.

3. For a useful evaluation of the state of the art see:

Raymond Platig, International Relations Research, Clio Press, Santa Barbara, 1967.

4. Singer comments, "...very little of the scientific work in international politics is published yet. That which is available to the entire scholarly community is often in journals that have not yet found their way to the traditionalist's desk. In a quick survey, I found that as of June 1967, there were still fewer than 100 English language articles which --- in my judgment --- fall in the scientific, data-based category, and of these, four were in World Politics and five in American Political Science Review, while the rest were in Journal of Conflict Resolution, Journal of Peace Research, Peace Research Society Papers, and General Systems. Moreover, with the time lag between submission and publication of an article, we rely increasingly on the exchange of pre-prints and other informal communications..."
- J. David Singer, "The Incomplete Theorist: Insight without Evidence," to appear in Knorr & Rosenau (eds) Contending Approaches to the Study of International Relations, forthcoming.

5. The exceptions to this are:

- a. Steven Brams, "The Structure of Influence Relationships in the International System," to be published in James N. Rosenau (ed) International Politics and Foreign Policy: A Reader in Research and Theory (rev. ed.: N. Y. Free Press, forthcoming 1969).
- b. Bruce Russett, International Regions and the International System: A Study in Political Ecology, Rand McNally, Chicago, 1967.
- c. R. J. Rummel, The Dimensions of Nations, forthcoming.

6. See: Mordecai Ezekiel and Karl A. Fox, Methods of Correlation and Regression Analysis., Third Edition, 1966, John Wiley & Sons, N.Y., Chapter 18. On the Effect of Random Error.

7. See Mosier's experimental findings on this point and Cattell's comments.

Charles I. Mosier, "Influence of Chance Error on Simple Structure: An Empirical Investigation of the Effect of Chance Error and Estimated Communalities on Simple Structure in Factorial Analysis," Psychometrika, 4 (1939), pp. 33-44.

Raymond Cattell, Factor Analysis, New York: Harper & Bros. 1952.

8. I will employ varimax and biquartimin techniques respectively.

9. Canonical analysis produces a coefficient which explains the amount of variance in the basis of one space which can be predicted given knowledge about the basis of the second space. The technique makes no assumption of independence or dependence associated with regression or factor comparison techniques. For a discussion see Donald F. Morrison, Multivariate Statistical Methods, 1967, McGraw Hill, N.Y. Chap. 6.

10. For an example of this technique in international relations, see R. J. Rummel, "Some Attributes and Behavioral Patterns of Nations," Journal of Peace Research, 1967, No. 2, pp. 196-206.

11. An extensive investigation has been completed on the interpretability of these two methods of grouping, using a city mileage (distance) table, W. R. Phillips, "Investigations into Alternative Techniques for Developing Empirical Taxonomies: The Results of Two Plasmodes," Dimensionality of Nations Research Report No. 15, mimeo, 1968.

## BIBLIOGRAPHY

1. Alker, Hayward, 1964, "Dimensions of Conflict in the United Nations," American Political Science Review, 56, pp. 642-57.
2. Allport, Gordon W., "The Role of Expectancy," in Bramson and Goethals (eds.) War: Studies from Psychology, Sociology and Anthropology, 1964, Basic Books, N. Y.
3. Ahmavaara, Yrjo, "On the Unified Factor Theory of Mind," Annales Academiæ Scientiarum Fennicæ, Ser. B, Tom 106, Helsinki, 1957
4. \_\_\_\_\_, "Transformation Analysis of Factorial Data," Annales Academiæ Scientiarum Fennicæ, Ser. B, Tom 88, 2 Helsinki, 1954
5. \_\_\_\_\_, and Touko Markkanen, "The Unified Factor Model: Its Position in Psychometric Theory and Application to Sociological Alcohol Study," Undenmaan Kirjapaino, Helsinki, 1958.
6. Boulding, Kenneth, "Conflict and Defense: A General Theory, New York: Harper & Row, 1962.
7. Brans, Steven, "Measuring the Concentration of Power in Political Systems," American Political Science Review, LXII June 1968, pp. 461-75.
8. Brody, Richard, "Some Systemic Effects of the Spread of Nuclear Weapons Technology: A Study through Simulation of a Multi-Nuclear Future," Journal of Conflict Resolution, Vol. VII, No. 4, pp. 663-753.
9. Burton, John W., International Relations: A General Theory, Cambridge: Cambridge University Press, 1965.
10. Bwy, Douglas P., "Dimensions of Social Conflict in Latin America," American Behavioral Scientist, II (March-April 1968) pp. 39-80.
11. Carr, E. H., Nationalism and After, London: Macmillan, 1945.
12. Carr, L. J., "A Situational Approach to Conflict and War," Social Forces, 24 (1946), pp. 300-303.
13. Cattell, Raymond, "The Data Box: Its Ordering of Total Resources in Terms of Possible Relational Systems," in Cattell(ed) Handbook of Multivariate Experimental Psychology, 1966, Rand McNally.
14. \_\_\_\_\_, "The Structuring of Change by P Technique and Incremental R technique," in Harris (ed) Problems in Measuring Change, 1962, pp. 167-198, Madison: University of Wisconsin Press.
15. \_\_\_\_\_, "The Dimensions of Cultural Patterns of Factorization of National Characters," Journal of Abnormal and Social Psychology, 44, 1949, pp. 443-69.
16. \_\_\_\_\_, "Higher Order Factor Structures and Reticular - vs. - Hierarchical Formulas for their Interpretation, in Charlotte Banks and P. L. Broodhurst, (eds.) Studies in Psychology, 1965, London: University of London Press

17. Cronbach, L. J. and Gleser, G. C., 1963, "Assessing Similarity between Profiles," Psychological Bulletin 50, pp. 456-473.
18. Denton, Frank and Warren R. Phillips, 1968, "Patterns in the History of Violence," Journal of Conflict Resolution, XII (June 1968) #2, pp. 182-195.
19. Deutsch, Karl, 1963, The Nerves of Government, New York: Free Press.
20. \_\_\_\_\_ and J. David Singer, 1964, "Multi-polar Power Systems and International Stability," World Politics, XVI, pp. 390-406.
21. Freud, Sigmund, 1964, "Why War" in Bramson and Goethals (eds.) War: Studies from Psychology, Sociology and Anthropology, New York: Basic Books.
22. Galtung, Johan, 1964, "A Structural Theory of Aggression," Journal of Peace Research, 2, pp. 15-38.
23. Grace, H. A. and J. O. Neuhaus, 1952, "Information and Social Distance as Predictors of Hostility towards Nations," Journal of Abnormal and Social Psychology, 47, pp. 540-45.
24. Gregg, Philip M. and Arthur S. Banks, 1965, "Dimensions of Political Systems: Factor Analysis of a Cross-Polity Survey," American Political Science Review, LIX, No. 3, pp. 602-614.
25. Guetzkow, Harold, 1950, "Long Range Research in International Relations," American Prospect, pp. 421-40.
26. Hall, Dennis, 1968, "Computer Program Profile," Research Report No. 14, Dimensionality of Nations Project, mimeo.
27. \_\_\_\_\_ and R. J. Rummel, 1968, "The Patterns of Dyadic Foreign Conflict Behavior for 1963," Research Report No. 12, The Dimensionality of Nations Project, mimeo.
28. Harary, Frank, 1961, "A Structural Analysis of the Situation in the Middle East in 1956," Journal of Conflict Resolution, Vol. V, No. 2, pp. 167-178.
29. Hass, Ernst B., 1967, "Collective Security and the Future International System," Institute of International Studies, University of California-Berkeley, mimeo.
30. \_\_\_\_\_, 1964, Beyond the Nation State: Functionalism and International Organization, Stanford: Stanford University Press.
31. Haas, Michael, 1965, "Societal Approaches to the Study of War," Journal of Peace Research, No. 4, pp. 307-23.
32. Heintz, Peter, 1968, "Two Simple Prestige-Power Models for Individual Mobility and System Change," Bulletin, #71, pp. 1-23.



33. Horovath, William J., 1967, "A Statistical Model for the Duration of Wars and Strikes, Mental Health Research Institute Preprint No. 203.
34. \_\_\_\_\_ and Claxton C Foster, 1963, "Stochastic Models of War Alliances," Journal of Conflict Resolution, Vol. VII, No. 2, pp. 110-116.
35. James, William, 1964, "The Moral Equivalent of War," in Bramson and Goethals (eds.) War: Studies from Psychology, Sociology, and Anthropology, New York: Basic Books.
36. Johnson, S. C., 1967, "Hierarchical Clustering Schemes, Psychometrika, Vol. 32, No. 3, pp. 241-254.
37. Liska, George, 1957, International Equilibrium, Cambridge: Harvard University Press.
38. McClelland, Charles A., 1960, "The Function of Theory in International Relations," Journal of Conflict Resolution, Vol. IV, No. 3, pp. 303-36.
39. \_\_\_\_\_, . "The Beginning, Duration, and Abatement of International Crises: Comparisons in Two Conflict Arenas," in Hermann (ed.) International Crises, forthcoming.
40. \_\_\_\_\_, 1966, Theory in the International System, New York: The MacMillan Company.
41. \_\_\_\_\_, 1967 "Access to Berlin: The Quantity and Variety of Events," in Singer (ed) Quantitative International Politics: Insights and Evidence. New York: Free Press.
42. \_\_\_\_\_ Darnall Harrison, Wayne Martin, Warren R. Phillips, and Robert A. Young, 1965; "Performance in Crisis and Non Crisis: Quantitative Studies of the Taiwan Straits Confrontation, 1950-64," Report to the Behavioral Sciences Group Naval Ordnance Test Station, China Lake, California, Contract #N60-530-11207.
43. McGuire, Martin C., 1965, Security and the Arms Race, A Theory of the Accumulation of Strategic Weapons and how Secrecy Affects it., Cambridge: Harvard University Press.
44. Mack, Raymond and Richard C. Snyder, 1957, "The Analysis of Social Conflict -- toward an Overview and Synthesis," Journal of Conflict Resolution, Vol. 1, pp. 212-248.
45. Mead, Margaret, 1964, "Warfare is only an Invention -- Not a Biological Necessity," in Leon Bramson and George W. Goethals (eds) War: Studies from Psychology, Sociology and Anthropology, New York: Basic Books.
46. Modelski, George, 1962, A Theory of Foreign Policy, New York: Praeger.

47. Morgenthau, Hans J., 1954, Politics Among Nations: The Struggle for Power and Peace, 2nd ed. New York: Alfred A. Knopf.
48. Moyal, J. E., 1949, "The Distribution of Wars in Time," Journal of the Royal Statistical Society, Vol. 112, pp. 446-449.
49. Naroll, Raoul, 1967, "Imperial Cycles and World Order," The Peace Research Society Papers, Vol. VII, pp. 83-102.
50. North, Robert, Ole Holsti, and Richard Brody, 1967, "Perception and Action in the Study of International Relations: the 1914 Case," in Singer (ed.) Quantitative International Politics, New York: Free Press.
51. Nunnally, J., 1962, "The Analysis of Profile Data," Psychological Bulletin, Vol. 59, No. 4, pp. 311-319.
52. Organski, A.F.K., 1958, World Politics, New York, Alfred A. Knopf.
53. Pear, T. H., 1950, Psychological Factors of Peace and War, New York: The Philosophical Library.
54. Platt, John R., 1966, The Step to Man, New York: Wiley & Sons.
55. Richardson, Lewis Fry, 1960, Statistics of Deadly Quarrels, Pittsburgh: Boxwood Press.
56. \_\_\_\_\_, 1960, Arms and Insecurity, Pittsburgh: Boxwood Press.
57. Riker, William C., 1962, Theory of Political Coalition, New Haven: Yale Press.
58. Rosecrance, Richard, 1963, Action and Reaction in World Politics: International Systems in Perspective, Boston: Little Brown & Co.
59. Rosenau, James, 1963, "Calculated Control as a Unifying Concept in the Study of International Politics and Foreign Policy," Center of International Studies, Research Report #15, Princeton, N.J.
60. Rummel, R. J., The Dimensions of Nations, forthcoming.
61. \_\_\_\_\_, Applied Factor Analysis, forthcoming, Evanston: Northwestern University Press.
62. \_\_\_\_\_, 1963, "Dimensions of Conflict Behavior Within and Between Nations," General Systems Yearbook, Vol. VIII, pp. 1-50.
63. \_\_\_\_\_, 1966, "A Foreign Conflict Code Sheet," in World Politics, Vol. XVIII, No. 2, pp. 283-96.
64. \_\_\_\_\_, 1964, "Dimensions of Error in Cross-National Data," to appear in Raoul Naroll and Ronald Cohen, (eds.) Handbook of Method in Cultural Anthropology.
65. \_\_\_\_\_, 1967, "Some Attributes and Behavioral Patterns of Nations," Journal of Peace Research, No. 2, pp. 196-206.

66. Rummel, R. J., 1965, "A Field Theory of Social Action with Application to Conflict Within Nations, General Systems Yearbook, Vol. 10, pp. 183-211.
67. \_\_\_\_\_, 1965, "A Social Field Theory of Foreign Conflict Behavior," Peace Research Society: Papers IV, Cracow Conference.
68. Russell, Bertrand and Alfred North Whitehead, 1910-1913, Principia Mathematica, Cambridge, England.
69. Russett, Bruce, 1967, International Regions and the International System: A Study in Political Ecology, Chicago: Rand McNally.
70. \_\_\_\_\_, 1963, "The Calculus of Deterrence," Journal of Conflict Resolution, Vol. VII, No. 2, pp. 97-109.
71. Schelling, Thomas, 1960, The Strategy of Conflict, Cambridge, Mass.: Harvard University Press.
72. Singer J. David, 1961, "The Level of Analysis Problem in International Relations," World Politics, Vol. 14, pp. 77-92.
73. \_\_\_\_\_ and Melvin Small, 1967, "Alliance Aggregation and the Onset of War, 1815-1945," in Singer (ed) Quantitative International Politics.
74. \_\_\_\_\_ and \_\_\_\_\_, 1966, "National Alliance Commitments and War Involvement," Papers of the Peace Research Society, Vol. 5 pp. 110-140.
75. Smoker, Paul, 1965, "Trade, Defense, and the Richardson Theory of Arms Race: A Nation Study, Journal of Peace Research, Vol. VII, pp. 161-178.
76. \_\_\_\_\_, "A Time Series Analysis of the Sino Indian Relations," Paper presented to the Second International Peace Research Association Conference, Tullberg, Sweden, June 17-19, 1967.
77. \_\_\_\_\_, "1964, "Sino-Indian Relations: A Study of Trade, Communication and Defense," Journal of Peace Research, No. 2, pp. 65-76.
78. \_\_\_\_\_, 1964, "Fear in the Arms Race: a Mathematical Study," Journal of Peace Research, No. 1, pp. 55-61.
79. Snyder, Richard C., 1954, Decision-Making or an Approach to the Study of International Relations, Princeton, N. J.: Foreign Policy Analysis Project.
80. \_\_\_\_\_ and Glenn Paige, 1958, "The United States Decision to Resist Aggression in Korea," Administrative Science Quarterly, Vol. III, pp. 341-378.

81. Sokal, Robert R. and Peter H. H. Sneath, 1963, Principles of Numerical Taxonomy, San Francisco: W. H. Freeman and Company.
82. Sonderman, Fred A., 1961, "The Linkage Between Foreign Policy and International Politics," in Rosenau (ed) International Politics and Foreign Policy, New York: Free Press, pp. 8-17.
83. Sprout, Harold and Margret, 1962, Foundations of International Politics, Princeton: D. Van Nostrand Company.
84. Tanter, Raymond and Manus Medlarsky, 1967, "Towards a Theory of Political Instability in Latin America," Journal of Peace Research, No. 3, pp. 209-227.
85. \_\_\_\_\_, 1966, "Dimensions of Conflict Behavior Within and Between Nations, 1958-60," Journal of Conflict Resolution, Vol. X, No. 1, pp. 41-64.
86. Tucker, Ledyard, 1963, "Some Mathematical Notes on 3 Mode Factor Analysis," Psychometrika, Vol. 31, No. 3, pp. 279-312.
87. \_\_\_\_\_, 1962, "Implications of Factor Analysis of Three Way Matrices for Measurement of Change," in Harris, Problems in Measuring Change, pp. 122-137, Madison: University of Wisconsin Press.
88. Ward, J. H. Jr., 1963, "Hierarchical Grouping to Optimize an Objective Function," Journal of the American Statistical Association, No. 58, pp. 236-44.
89. Weiss, Herbert, 1963, "Stochastic Models for the Duration and Magnitude of a Deadly Quarrel," Operations Research, No. 11, pp. 101-21.
90. Weiss, Herbert, 1966, "Trends in World Involvement in War," Palos Verdes, mimeo.
91. Whiting, Allan S., 1960, China Crosses the Yalu, New York: MacMillan Co.
92. Wright, Quincy, 1954, Problems of Stability and Progress in International Relations, Berkeley and Los Angeles: University of California Press.
93. \_\_\_\_\_, 1942, The Study of War, Vol. 1-2, Chicago: University of Chicago Press.
94. Young, Robert R. and Wayne Martin, 1966, "World Event- Interaction Study: Pilot Study Report," Ann Arbor: University of Michigan, mimeo.
95. Zimmes, Dina, 1968, "The Expression and Perception of Hostility in Pre-War Crisis: 1914," in Singer (ed) Quantitative International Politics.
96. \_\_\_\_\_, 1965, "A Markovian Analysis of Hostile Communications Between Nations," A Research Proposal Submitted to the Division of Social Sciences, National Science Foundation.